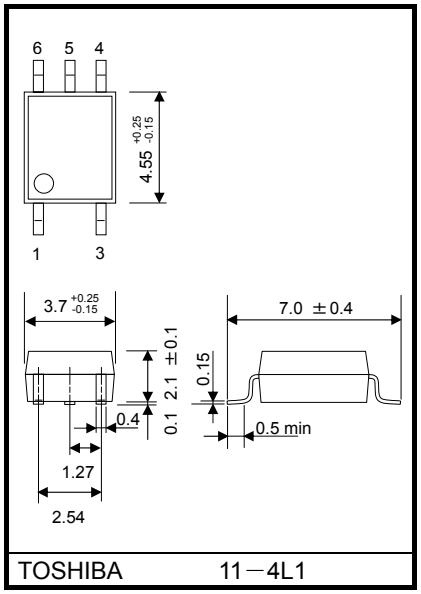
TOSHIBA Photocoupler GaAℓAs Ired & Photo-IC

TLP109(IGM)

Intelligent Power Module (IPM)
Digital Logic Isolation
Industrial Inverters

Unit: mm



TOSHIBA 11−4L1

Weight: 0.08 g (Typ.)

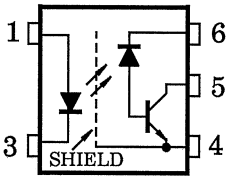
The Toshiba TLP109(IGM) mini-flat coupler is a small-outline coupler suitable for surface-mount assembly.
The TLP109(IGM) consists of a high-output-power GaAℓAs light emitting diode optically coupled to a high-speed photodiode-transistor chip.
The TLP109(IGM) is housed in the SO6 package and guarantees a creepage distance of ≥ 5.0 mm, a clearance of ≥ 5.0 mm and an insulation thickness of ≥ 0.4 mm. Therefore, the TLP109(IGM) meets the reinforced insulation class requirements of international safety standards.
The TLP109(IGM) guarantees minimum and maximum of propagation delay time, switching time dispersion, and high common mode transient immunity. Therefore TLP109(IGM) is suitable for isolation interface between IPM(Intelligent Power Module) and control IC circuits in motor control application.

- Isolation voltage: 3750 Vrms (min)
- Common mode transient immunity: ±10 kV/μs(min)
  @V_{CM}=1500 V
- Switching time: t_{pHL}, t_{pLH}=0.1 μs(min)
  =0.8 μs(max)
  @I_F=10 mA, V_{CC}=15 V,
  R_L=20 kΩ, Ta=25°C
- Switching time dispersion: 0.7 μs(max)
  ($|t_{pLH}-t_{pHL}|$)
- TTL compatible
- UL approved :UL1577, File No.E67349
- c-UL approved :CSA Component Acceptance Service No. 5A, File No.E67349
- Option (V4)
  VDE approved : DIN EN60747-5-2

  Maximum Operating Insulation Voltage : 707 V_{PK}
  Highest Permissible Over Voltage : 6000 V_{PK}
  (Note) : When a EN60747-5-2 approved type is needed, Please designate "Option(V4)"

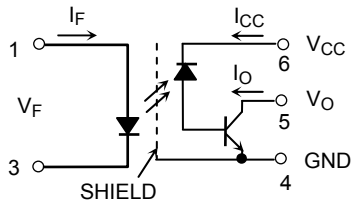
- Construction Mechanical Ratings
  Creepage distance: 5.0 mm (min)
  Clearance distance: 5.0 mm (min)
  Insulation thickness: 0.4 mm (min)

Pin Configuration (Top View)



1: ANODE
3: CATHODE
4: EMITTER (GND)
5: COLLECTOR (OUTPUT)
6: V_{CC}

Schematic



Absolute Maximum Ratings (Ta = 25°C)

Characteristic			Symbol	Rating	Unit
LED	Forward current	(Note 1)	I_F	20	mA
	Pulse forward current	(Note 2)	I_{FP}	40	mA
	Peak transient forward current	(Note 3)	I_{FPT}	1	A
	Reverse voltage		V_R	5	V
Detector	Output current		I_O	8	mA
	Peak output current		I_{OP}	16	mA
	Supply voltage		V_{CC}	−0.5 to 30	V
	Output voltage		V_O	−0.5 to 20	V
	Output power dissipation	(Note 4)	P_O	100	mW
Operating temperature range			T_{opr}	−55 to 125	°C
Storage temperature range			T_{stg}	−55 to 125	°C
Lead solder temperature (10 sec.)			T_{sol}	260	°C
Isolation Voltage (AC,1 min., R.H.≤ 60°%)		(Note 5)	BV_S	3750	Vrms

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

(Note 1) Derate 0.36 mA / °C above 95°C.

(Note 2) 50% duty cycle, 1 ms pulse width. Derate 0.72 mA / °C above 95°C.

(Note 3) Pulse width ≤ 1 μs, 300 pps.

(Note 4) Derate 1.8 mW / °C above 95°C.

(Note 5) Device considered a two−terminal device: Pins 1 and 3 shorted together, and pins 4, 5 and 6 shorted together.

Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Forward voltage	V_F	I_F = 16 mA	1.50	1.64	1.85	V
	Forward voltage temperature coefficient	$\Delta V_F / \Delta Ta$	I_F = 16 mA	—	−1.8	—	mV /°C
	Reverse current	I_R	V_R = 3 V	—	—	10	μA
	Capacitance between terminals	C_T	V_F = 0 V, f = 1 MHz	—	60	—	pF
Detector	High level output current	$I_{OH\ (1)}$	I_F = 0 mA, V_{CC} = V_O = 5.5 V	—	3	500	nA
		$I_{OH\ (2)}$	I_F = 0 mA, V_{CC} = 30 V, V_O = 20 V	—	—	5	μA
		I_{OH}	I_F = 0 mA, V_{CC} = 30 V, V_O = 20 V, Ta = 100°C	—	—	50	
	High level supply current	I_{CCH}	I_F = 0 mA, V_{CC} = 30 V	—	0.01	1	μA
Supply voltage		V_{CC}	I_{CC} = 0.01 mA	30	—	—	V
Output voltage		V_O	I_O = 0.5 mA	20	—	—	V

Coupled Electrical Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Current transfer ratio	I_O / I_F	I_F = 10 mA, V_{CC} = 4.5 V, V_O = 0.4 V	25	35	75	%
		I_F = 10 mA, V_{CC} = 4.5 V, V_O = 0.4 V, Ta = −25 to 100 °C	15	—	—	
Low level output voltage	V_{OL}	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 2.4 mA	—	—	0.4	V

Isolation Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Capacitance input to output	C_S	V = 0 V, f = 1 MHz (Note 5)	—	0.8	—	pF
Isolation resistance	R_S	R.H. ≤ 60%, V_S = 500 V (Note 5)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC,1 minute	3750	—	—	V_{rms}
		AC,1 second, in oil	—	10000	—	
		DC,1 minute, in oil	—	10000	—	Vdc

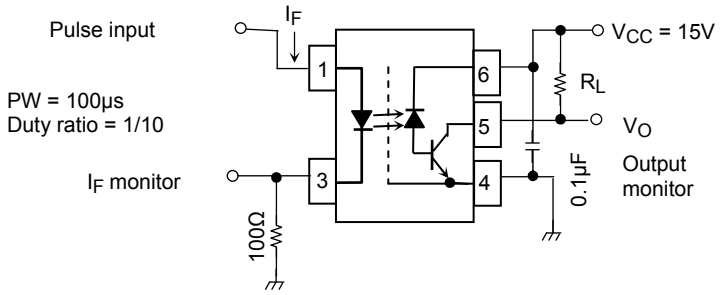
Switching Characteristics (Ta = 25°C, V_{CC} = 15 V)

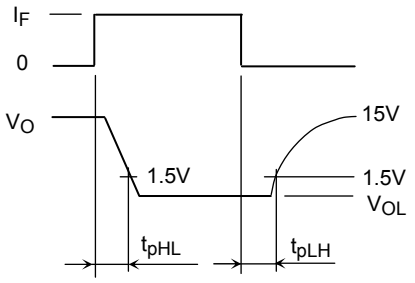
Characteristic	Symbol	Test Cir- Cuit	Test Condition	Min.	Typ.	Max.	Unit
Propagation delay time (H→ L) Propagation delay time (L→ H)	t_{pHL} t_{pLH}	1	I_F=10 mA, R_L=20 kΩ	0.1	0.45	0.8	μs
			I_F=10 mA, R_L=20 kΩ Ta=0 to 85°C	0.1	0.45	0.9	
			I_F=10 mA, R_L=20 kΩ Ta=−25~100°C	0.1	0.45	1.0	
Switching time dispersion between on and off	$\|t_{pLH}-t_{pHL}\|$		I_F=10 mA, R_L=20 kΩ	—	0.15	0.7	μs
			I_F=10 mA, R_L=20 kΩ Ta=0 to 85°C	—	0.25	0.8	
			I_F=10 mA, R_L=20 kΩ Ta=−25 to 100°C	—	0.25	0.9	
Common mode transient immunity at logic high output (Note 6)	CM_H	2	I_F=0 mA, V_{CM}=1500 V_{p-p} R_L=20 kΩ	10000	15000	—	V / μs
Common mode transient immunity at logic low output (Note 6)	CM_L		I_F=10 mA, V_{CM}=1500 V_{p-p} R_L=20 kΩ	−10000	−15000	—	V / μs

(Note 6) CM_L is the maximum rate of fall of the common mode voltage that can be sustained with the output voltage in the logic low state (V_O < 1 V).
CM_H is the maximum rate of rise of the common mode voltage that can be sustained with the output voltage in the logic high state (V_O > 4 V).

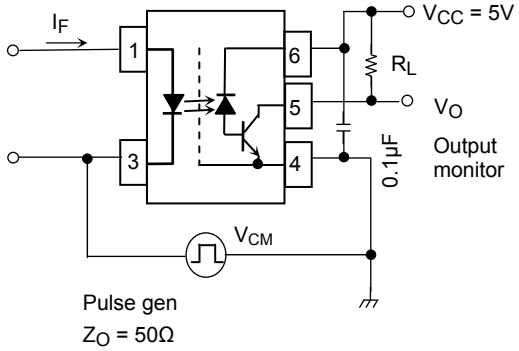
(Note 7) Maximum electrostatic discharge voltage for any pins: 100 V (C = 200 pF, R=0).

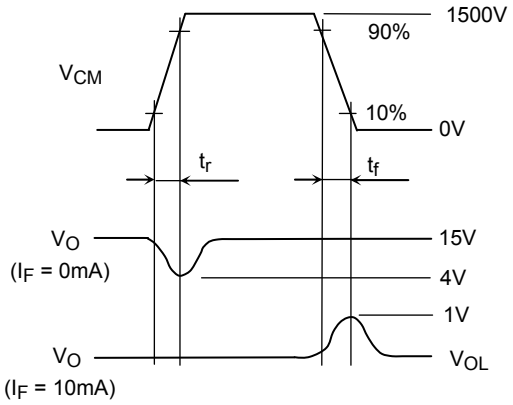
Test Circuit 1: Switching Time Test Circuit





Test Circuit 2: Common Mode Transient Immunity Test Circuit





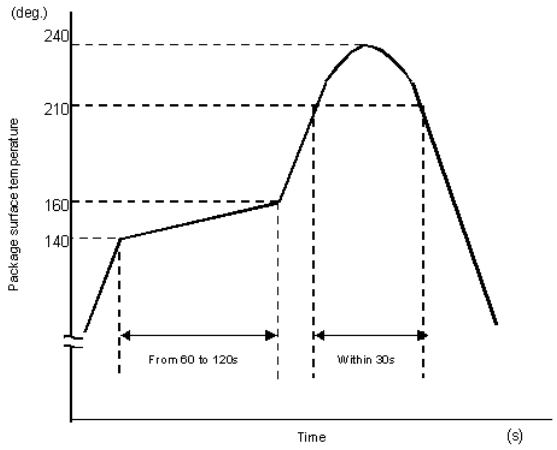
$$CM_H = \frac{1200(V)}{t_r(\mu s)}, CM_L = \frac{1200(V)}{t_f(\mu s)}$$

PRECAUTIONS OF SURFACE MOUNTING TYPE PHOTOCOUPLER SOLDERING & GENERAL STORAGE

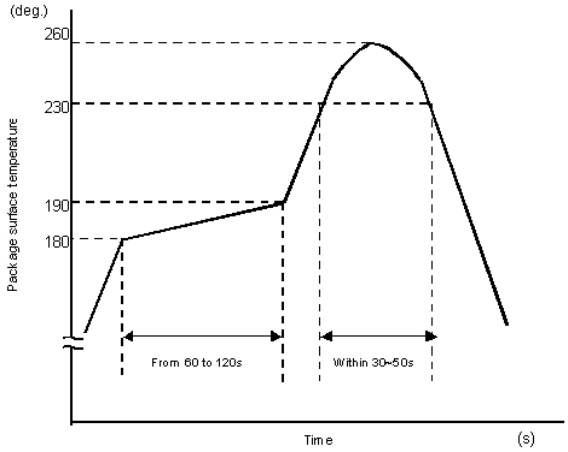
(1) Precautions for Soldering

1) When Using Soldering Reflow

- An example of a temperature profile when Sn-Pb eutectic solder is used:



- An example of a temperature profile when lead(Pb)-free solder is used:



- Reflow soldering must be performed once or twice.
- The mounting should be completed with the interval from the first to the last mountings being 2 weeks.

2) When using soldering flow (Applicable to both eutectic solder and Lead(Pb)-Free solder)

- Apply preheating of 150 deg.C for 60 to 120 seconds.
- Mounting condition of 260 deg.C or less within 10 seconds is recommended.
- Flow soldering must be performed once.

3) When using soldering iron (Applicable to both eutectic solder and Lead(Pb)-Free solder)

- Complete soldering within 10 seconds for lead temperature not exceeding 260 deg.C or within 3 seconds not exceeding 350 deg.C.
- Heating by soldering iron must be only once per lead.

(2) Precautions for General Storage

1) Do not store devices at any place where they will be exposed to moisture or direct sunlight.

2) When transportation or storage of devices, follow the cautions indicated on the carton box.

3) The storage area temperature should be kept within a temperature range of 5 degree C to 35 degree C, and relative humidity should be maintained at between 45% and 75%.

4) Do not store devices in the presence of harmful (especially corrosive) gases, or in dusty conditions.

5) Use storage areas where there is minimal temperature fluctuation. Because rapid temperature changes can cause condensation to occur on stored devices, resulting in lead oxidation or corrosion, as a result, the solderability of the leads will be degraded.

6) When repacking devices, use anti-static containers.

7) Do not apply any external force or load directly to devices while they are in storage.

8) If devices have been stored for more than two years, even though the above conditions have been followed, it is recommended that solderability of them should be tested before they are used.

Specification for Embossed–Tape Packing (TPL)(TPR) for SO6 Coupler

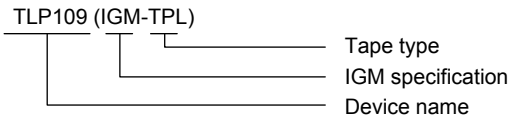
1. Applicable Package

Package	Product Type
SO6	Mini-flat coupler

2. Product Naming System

Type of package used for shipment is denoted by a symbol suffix after a product number. The method of classification is as below.

(Example)



3. Tape Dimensions

3.1 Specification Classification Are as Shown in Table 1

Table 1 Tape Type Classification

Tape type	Classification	Quantity (pcs / reel)
TPL	L direction	3000
TPR	R direction	3000

3.2 Orientation of Device in Relation to Direction of Tape Movement

Device orientation in the recesses is as shown in Figure 1.

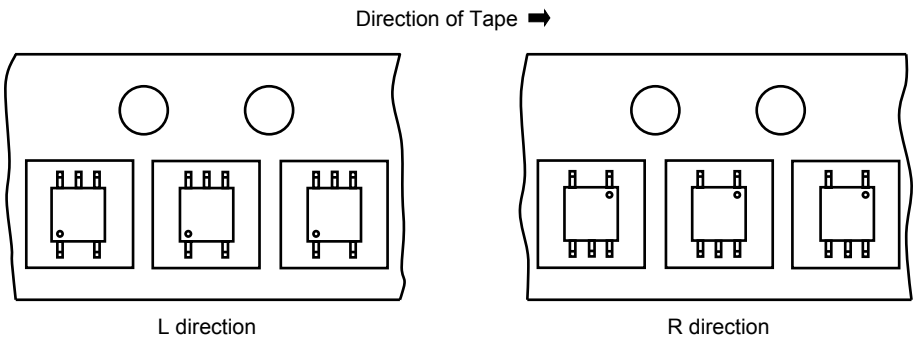


Figure 1 Device Orientation

3.3 Empty Device Recesses Are as Shown in Table 2.

Table 2 Empty Device Recesses

	Standard	Remarks
Occurrences of 2 or more successive empty device recesses	0	Within any given 40-mm section of tape, not including leader and trailer
Single empty device recesses	6 devices (max) per reel	Not including leader and trailer

3.4 Start and End of Tape

The start of the tape has 50 or more empty holes. The end of tape has 50 or more empty holes and two empty turns only for a cover tape.

3.5 Tape Specification

(1) Tape material: Plastic (protection against electrostatics)
(2) Dimensions: The tape dimensions are as shown in Figure 2 and Table 3.

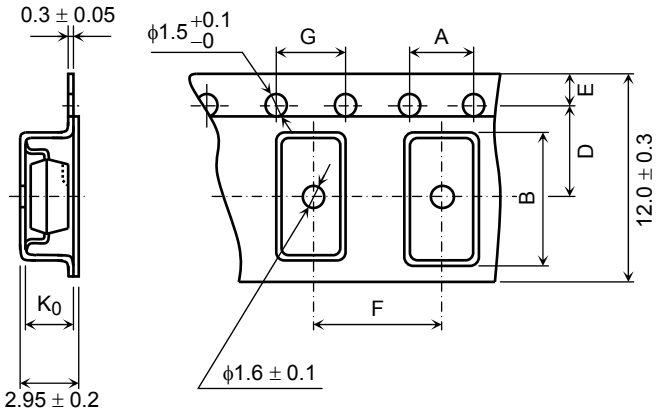


Figure 2 Tape Forms

Table 3 Tape Dimensions

Unit: mm
Unless otherwise specified: ±0.1

Symbol	Dimension	Remark
A	4.0	—
B	7.6	—
D	5.5	Center line of indented square hole and sprocket hole
E	1.75	Distance between tape edge and hole center
F	8.0	Cumulative error $^{+0.1}_{-0.3}$ (max) per 10 feed holes
G	4.0	Cumulative error $^{+0.1}_{-0.3}$ (max) per 10 feed holes
K_0	2.6	Internal space

3.6 Reel

(1) Material: Plastic

(2) Dimensions: The reel dimensions are as shown in Figure 3 and Table 4.

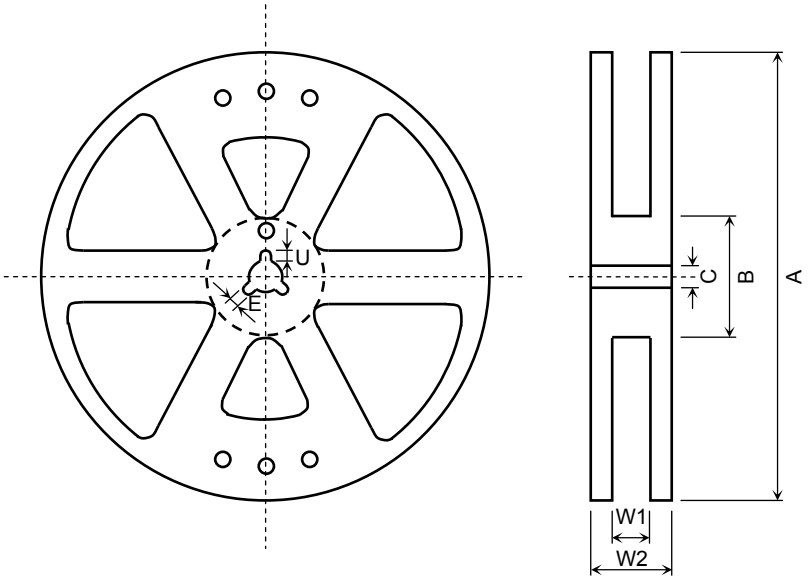


Figure 3 Reel Form

Table 4 Reel Dimensions

Unit: mm

Symbol	Dimension
A	Φ380 ±2
B	Φ80 ±1
C	Φ13 ±0.5
E	2.0 ±0.5
U	4.0 ±0.5
W1	13.5 ±0.5
W2	17.5 ±1.0

4. Packing

Either one reel or five reels of photocoupler are packed in a shipping carton.

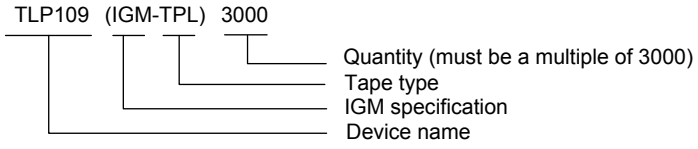
5. Label Indication

The carton bears a label indicating the product number, the symbol representing classification of standard, the quantity, the lot number and the Toshiba company name.

6. Ordering Method

When placing an order, please specify the product number, the tape type and the quantity as shown in the following example.

(Example)



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